

# 切換式整流器供電單相感應馬達風扇之研製

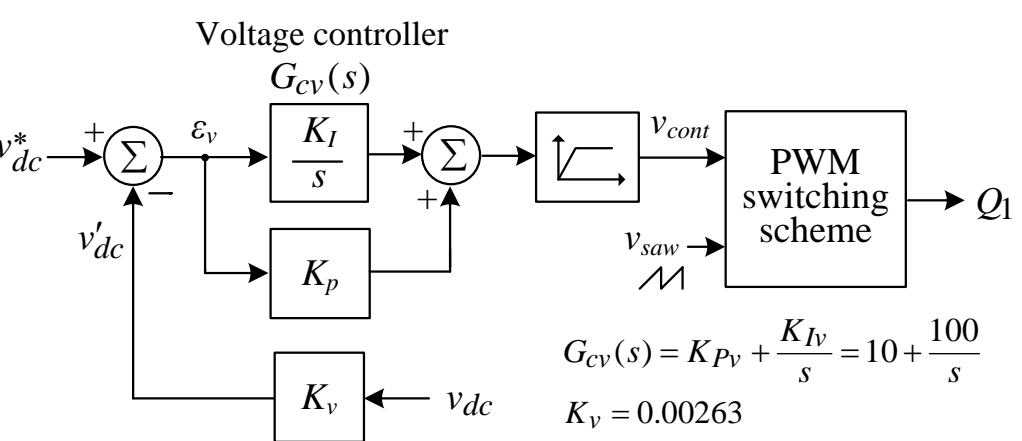
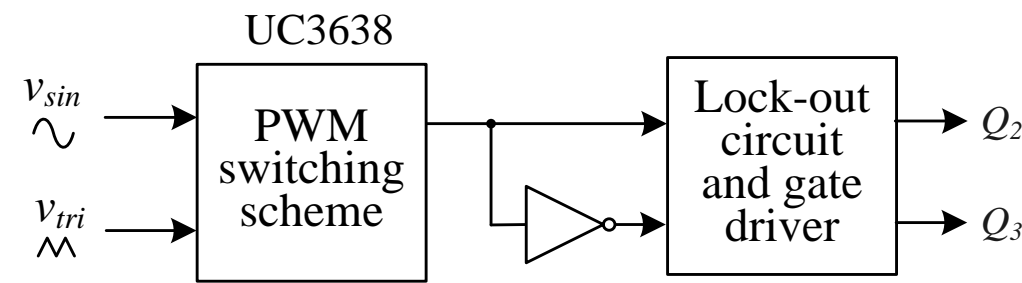
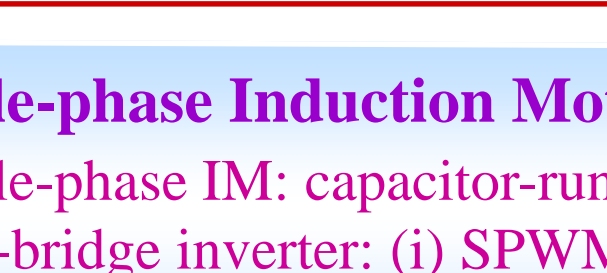
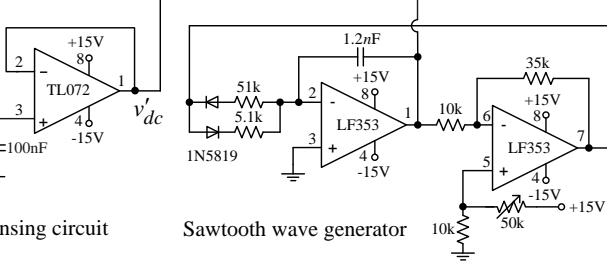
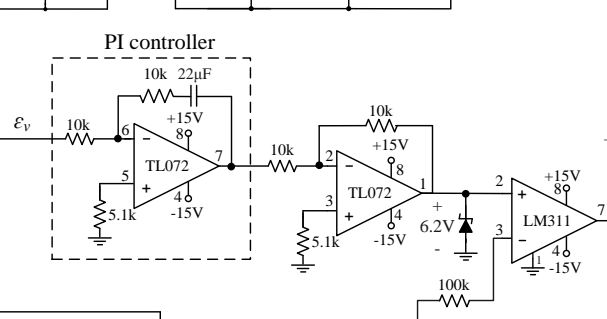
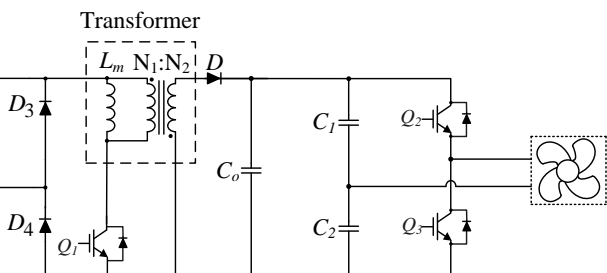
(Development of a switch-mode rectifier powered Single-phase induction motor driven fan)

組員：楊庭碩

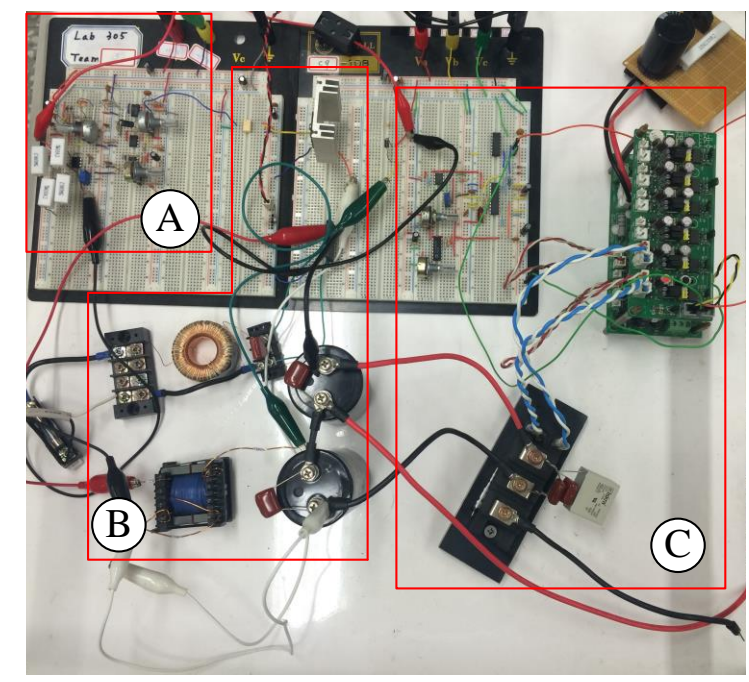
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## Circuit and control schemes of the developed SMR-fed motor-driven fan

Flyback SMR fed IPIM driven fan



## Setup photos of the developed SMR-fed motor-driven fan



(A) SMR control and logic circuits (B) discrete-based SMR (C) half bridge inverter (D) IM driving fan

### A. Single-phase Induction Motor Driven Fan:

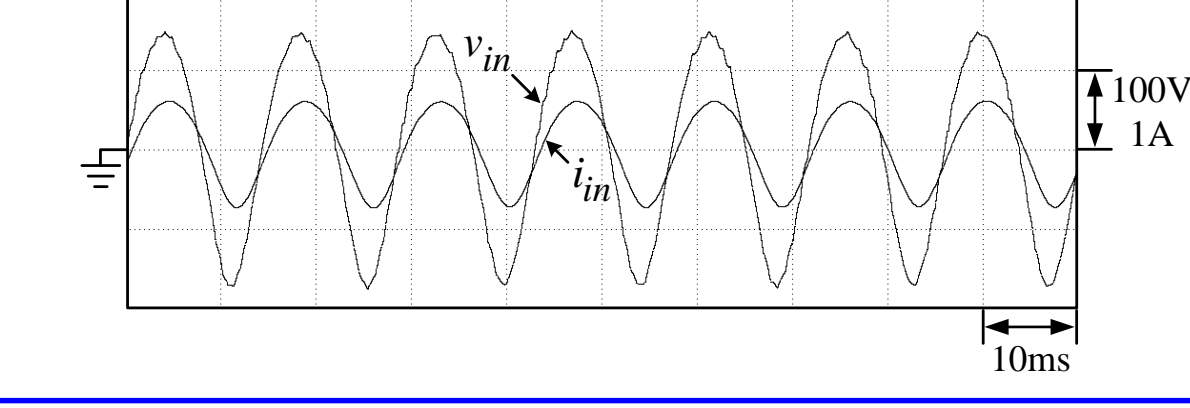
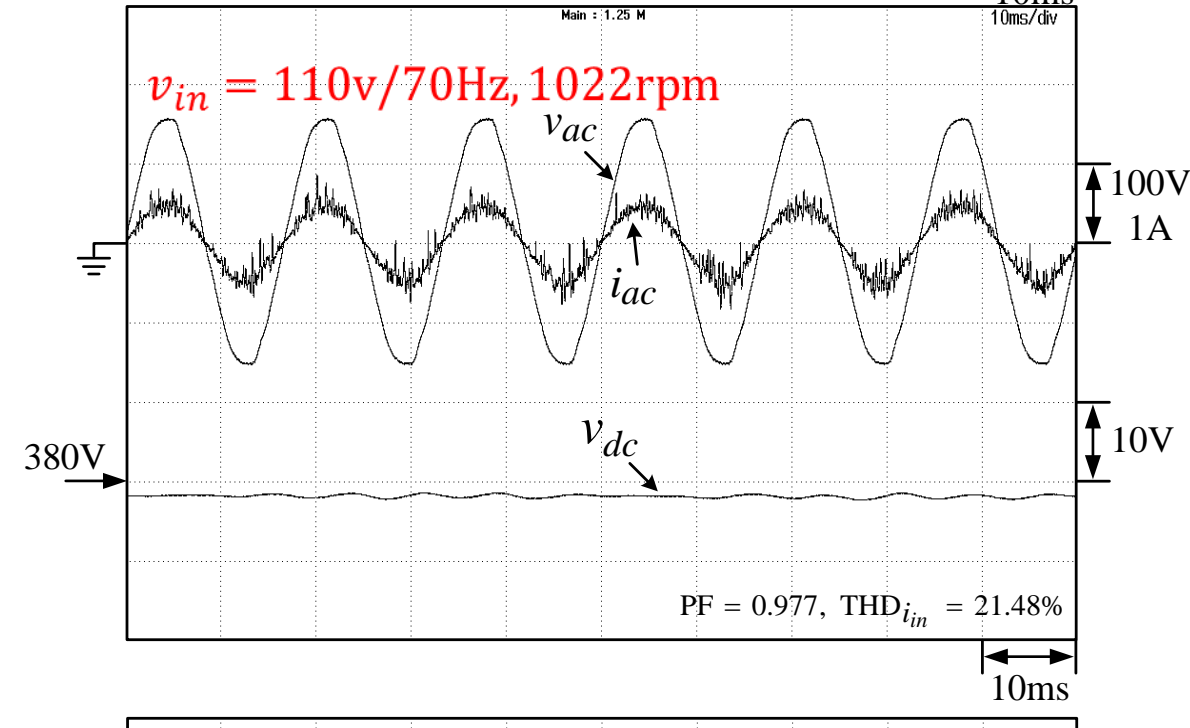
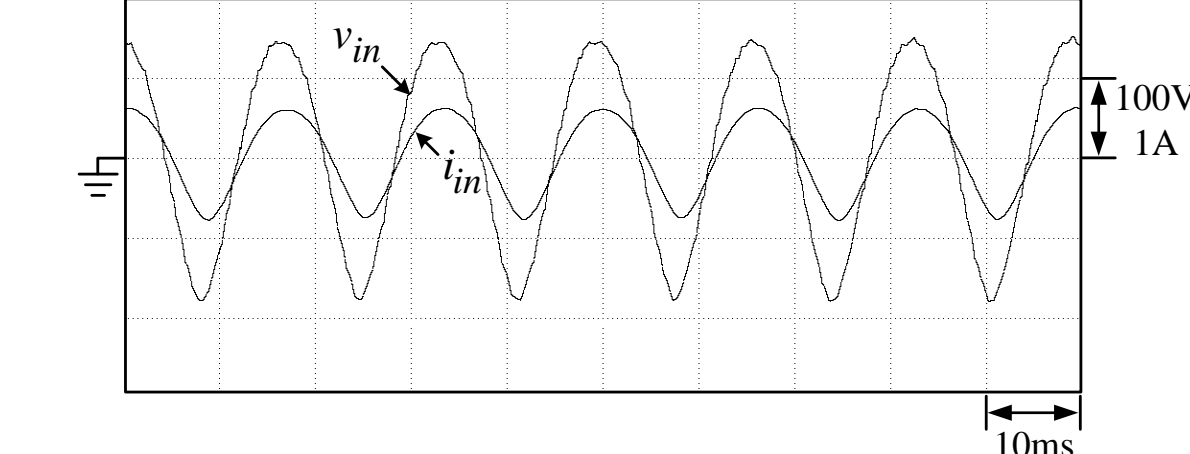
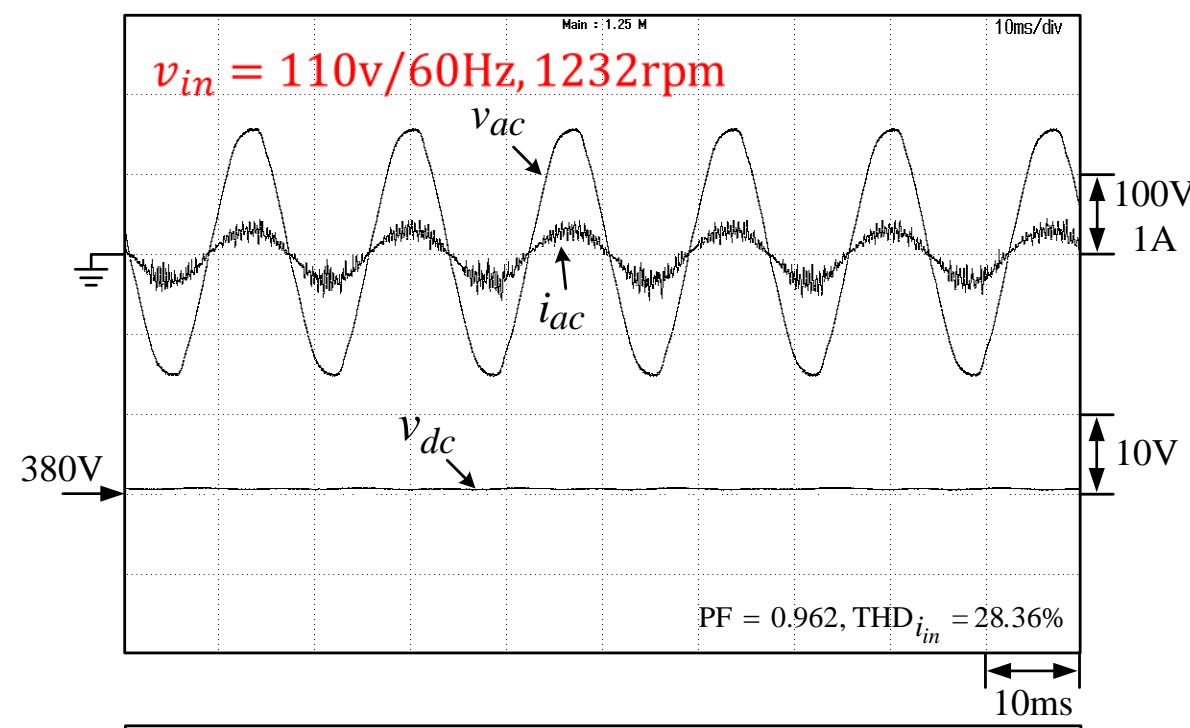
- ✓ (a) Single-phase IM: capacitor-run type, 70W, 110V/60Hz.
- ✓ (b) Half-bridge inverter: (i) SPWM switching adopted. (ii) IGBT module CM100DY-12H (Mitsubishi)

### B. Flyback SMR:

- ✓ (a) Diode rectifier:
- ✓ (b) Flyback SMR: (i) operated under DCM; (ii) realized using analog circuit. (iii) IGBT module FGL40N120AND (Fairchild)

## Results: Measured steady-state characteristics of the established flyback SMR fed single-phase induction motor driven fan under various frequencies.

- AC source:  $V_{ac} = 110V/60Hz$ .
- DC-link voltage:  $V_{dc} 380V$
- The inverter output voltage and current:  $(v_{in}, i_{in})$
- Measured  $(v_{ac}, i_{ac}, v_{dc})$  and  $(v_{in}, i_{in})$  at 30Hz, 40Hz, 50Hz, 60Hz and 70Hz plotted in figure and listed in table



Frequency	30Hz	40Hz	50Hz	60Hz	70Hz
$V_{ac}(rms)$	110.23/60Hz	110.81/60Hz	111.17/60Hz	110.63/60Hz	110.83/60Hz
$I_{ac}(rms)$	316mA	388.1mA	498.3mA	759.8mA	690.5mA
$P_{ac}$	32.89W	41.27W	53.65W	80.84W	75.48W
$V_{dc}$	375.4V	379.9V	376.4V	377.7V	379V
$I_{dc}$	140.1mA	159.94mA	236.2mA	315mA	300.7mA
$P_{dc}$	22.18W	26.3W	43.58W	60.26W	57.25W
$V_{in}(rms)$	55.38V	73.74V	91.57V	113.93V	110.99V
$I_{in}(rms)$	238.4mA	292.7mA	360.3mA	480mA	466.8mA
$P_{in}$	12.49W	20.6W	31.78W	52.88W	49.89W
$\eta_1$	67.43%	63.73%	81.23%	74.54%	75.85%
$\eta_2$	56.31%	78.33%	72.92	87.75%	87.14%
$\eta$	37.96%	49.92%	59.24%	65.41%	66.10%
Speed	582rpm	848rpm	1060rpm	1232rpm	1022rpm
$THD_i$	34.6%	29.1%	25.67%	28.36%	21.48%
PF(Lagging)	0.944	0.96	0.969	0.962	0.977

\*  $\eta_1 \equiv P_{dc}/P_{ac}$ ,  $\eta_2 \equiv P_{in}/P_{dc}$ ,  $\eta \equiv P_{in}/P_{ac}$